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Performance-Based Logistics: Examining the Successes and Challenges When Operating in Stressful Environments

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Panel 11. Enabling Successful Outcomes in Performance Based Logistics

Thursday, May 5, 2016	
9:30 a.m. – 11:00 a.m.	**Chair: Stan Soloway,** President and CEO, Celero Strategies, LLC ***Performance-Based Logistics: Examining the Successes and Challenges When Operating in Stressful Environments*** William Lucyshyn, Senior Research Scholar, Center for Public Policy and Private Enterprise, UMD John Rigilano, Faculty Research Assistant, Center for Public Policy and Private Enterprise, UMD Darya Safai, Graduate Research Associate, School of Public Policy, UMD ***Effective PBLs Through Simultaneous Optimization and Simulation of Maintenance, Manpower, and Spare Parts*** Justin Woulfe, Executive Vice President, Technical Services, Systecon North America Samantha Alpert, Analyst, Systecon North America ***Future Contracting for Availability*** Lou Kratz, Vice President and Managing Director, Logistics & Sustainment, Lockheed Martin Bradd Buckingham, Senior Market Research Planner, Logistics & Sustainment, Lockheed Martin

Performance-Based Logistics: Examining the Successes and Challenges When Operating in Stressful Environments[1]

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Introduction

Given current and anticipated budgetary constraints, the Department of Defense (DoD) must heighten its focus on affordability, especially with regard to operation and maintenance costs, which account for almost two thirds of the defense budget. At the same time, new and evolving threats demand superior technology that is highly-reliable. To a large extent, these twin objectives—reduced costs and better performance—can be achieved through the wider implementation of performance-based logistics (PBL) contracting, a proven strategy to obtain economical and innovative support solutions. Unfortunately, however, PBL contracting is not being aggressively pursued across the DoD.

Under traditional sustainment strategies, the government customer purchases spares, repairs, tools, and data in individual transactions. In contrast, PBL transfers inventory management, technical support, and the supply chain function to a provider, typically a private-sector contractor, who guarantees a specified level of performance, often at a fixed price to the government. In effect, this arrangement aligns both parties' objectives. The contractor strives to reduce a system's "downtime" through cost-efficient maintenance and technical improvements.

[1] This is a summary of the full report that will be released in June 2016.

Yet, despite their success, the number of PBL-supported systems has declined. In 2005, there were more than 200 PBL contracts in place within the DoD, with spending on PBL projects having more than tripled since their inception—from $1.4 billion in 2001 to $5 billion in 2009. Yet by 2013, the number of PBL contracts had dropped to 87, while total DoD sustainment costs continued to increase (Irwin, 2013). We believe that while PBL may appeal to users and program officials from a theoretical standpoint, some may be reluctant to embrace this strategy for fear that PBL arrangements may falter when supported systems are deployed in emergency and contingency operations.

This perception manifests itself in a number of ways. For instance, some question whether the PBL mechanism is flexible enough to adapt to rapidly-changing conditions, that perhaps PBL works—until it doesn't. There is also concern over whether contractors will be able to perform at the same high level during emergency and contingency operations, especially if these providers are deployed in theater. To address the validity of these claims, we examine the performance of four PBL sustainment programs that have operated in stressful environments.

A 2007 Congressional Budget Office (CBO) report noted that during the conflicts in Iraq and Afghanistan, major weapons systems operated at rates that exceeded—sometimes by factors of five or six—their average operating rates during peacetime. Chief among these were combat vehicles and helicopters, systems that required the highest levels of repair and reconditioning. We examine four such systems: the Stryker Armored Combat Vehicle, the High Mobility Artillery Rocket System (HIMARS), the Apache AH-64 helicopter, and the H-60 helicopter.

Not only are these among the most deployed PBL-supported systems, they represent a diversity of PBL arrangements with regard to contract type, terms, and length. For instance, the H-60 program encompasses a suite of PBLs that cover different subsystems, while the Apache PBL covers one component, the fire control system. In both cases, the required maintenance is performed by military personnel, with contractors responsible for supply chain operations and parts requisition. In contrast, both the HIMARS and Stryker programs relied on contractors working in theater with military personnel to perform maintenance and repair.

It is noteworthy that these two programs reverted to the use of a traditional support strategy for some functions; the Stryker program now relies on soldiers, not contractors, for maintenance and repair, both at home and in theater, while HIMARS shifted to organic inventory management. Needless to say, these developments add to the perception that the PBL mechanism may not be a practical support solution for highly-deployed systems. We address this concern through a detailed examination of the history, attributes, and, performance of these PBL programs.

Stryker

The DoD's first new vehicle since the early 1990s, the M1126 Stryker Combat vehicle is a rapidly-deployable wheeled armored vehicle, combining mobility, survivability, and versatility in combat environments with firepower and reduced logistics requirements (Boyer et al., 2015). Its lightweight design allows for easy transport by C-130 aircraft anywhere in the world within 96 hours, making it an extremely desirable commodity in unpredictable combat situations (GAO, 2006).

The Stryker vehicle's acquisition process was among the fastest of any major army system. The urgent need for an innovative and rapidly-deployable (anywhere within 96 hours) armored vehicle to meet demands in Iraq and Afghanistan, where improvised

explosive devices (IEDs) were quickly becoming the number one threat to U.S. troops, played a major role in this expedited process (Coryell, 2007). The Stryker PBL was first implemented in 2002; in 2007 and 2012, follow-on contracts valued at $1.5 billion and $2.5 billion, respectively, extended support for an increasing number of vehicles (McLeary, 2014). Given the Army's heavy reliance on Stryker during these conflicts, the use of PBL, if successful, would go a long way in legitimizing PBL as a leading support strategy for deployed systems.

Under the PBL arrangement initiated in May 2002, General Dynamics assumed responsibility for the ordering, management, and distribution of all spare parts, as well as provision of any and all vehicle maintenance services (Coryell, 2007). Contractor personnel performed an array of functions, including wheeled vehicle mechanics, armament repairer, or automated logistics specialists. On account of Stryker's short operational history and unknown vulnerabilities, the PBL relied on a cost plus fixed fee contract (Coryell, 2007).

In short order, however, General Dynamics was able to implement a number of design and process innovations, including an ability to self-sustain operations for up to 72 hours, an array of on-system repair enablers, and logistics surge capabilities (Coryell, 2007). Ultimately, these innovations served to minimize the number of personnel and parts needed within each Stryker brigade while ensuring that the vehicles were prepared for sudden increases in operational tempo.

The PBL contract required a monthly readiness rate of 90% during deployments. Stateside, a 98% monthly rate was used during training exercises and a rate of 90% was used in garrison. Stryker continuously exceeded expectations, achieving, for example, 95% cumulative readiness during the height of the war in Iraq—a war in which Stryker vehicles were driven in excess of 6.5 million miles (Coryell, 2007).

From a cost perspective, however, contract performance is less clear. In 2012, DoD Inspector General asserted that the follow-on contract's continued use of a sole metric (system readiness) in combination with a high-ceiling, cost-plus contract unduly incentivized the contractor to accumulate significant excess inventory valued at $335.9 million (DoD IG, 2012). The Army responded that the excess inventory could be attributed, in part, to contractor improvements in reliability, and that the spare parts would be used eventually, albeit at a slower pace than anticipated (DoD IG, 2012).

Given the Army's heavy reliance on Stryker during the Iraq War, changing operational tempos, and the lack of historical cost data, the use of a cost-plus fixed fee contract (as opposed to a fixed-price contract) was well-founded. However, it appears that the Army could have implemented better cost controls, perhaps by tying the fixed fee to an agreed-upon cost-per-mile metric.

In November 2005, citing a need for increased flexibility in different combat environments, the Army determined that soldiers, as opposed to contractors, would perform unscheduled maintenance for all Stryker vehicles (GAO, 2006). The Army's plan called for replacing 45 Stryker vehicle maintenance contractors with 71 soldiers. This transition relied on the Army's ability to annually recruit or retain 497 additional soldiers with specific military specialties to support all seven Stryker brigades (GAO, 2006). The GAO questioned the Army's plan, asserting, ironically, that the larger logistics footprint could negatively impact Stryker's deployment flexibility. In 2006, the Army began the transition, which, at present, is still underway.

HIMARS

HIMARS is a wheeled, agile rocket and guided missile launcher. The Army awarded the first HIMARS PBL contract to Lockheed Martin in the amount of $96 million in February 2004 (Lockheed Martin, 2004). Given its increasing inventory of HIMARS, the existence of a successful partnership between the Army and Lockheed Martin, and the cost benefits that derive from economies of scale, the Marines sought to support its launchers through the same PBL upon completion of the initial contract.

HIMARS has been deployed extensively since PBL implementation in 2004, playing a significant role in operations in the Al Anbar province of Iraq. In January 2016, Lockheed Martin announced that HIMARS had reached one million operational hours with U.S. forces (Lockheed Martin, 2016).

By 2011, Lockheed Martin was supporting 620 Army and Marines fielded mobile launcher systems—396 HIMARS and 224 MLRS M270A1. A third PBL contract in the amount of $158 million extended HIMARS sustainment through December 2013 for services, and through December 2014 for hardware. The PBL strategy relied on firm-fixed price with incentive fee contracts for stateside operations and cost-plus fixed fee contracts for overseas contingency operations (Gardener, 2008). This strategy provided strong cost reduction incentives as well as the flexibility to meet overseas contingency requirements.

The PBL required that system readiness be maintained at or above 90%, and that response time fall within a specified range a certain percentage of the time, depending on the nature of the problem. For overseas operations, the response time ranges were extended to provide the flexibility necessary to meet fluctuations in demand that might arise in unpredictable operating environments (DoD, 2006).

The program consistently achieved these objectives at the required percentages, with the relative simplicity of the performance requirements facilitating straightforward monitoring and, thus, complete transparency. The HIMARS PBL program achieved success early on, reaching a 99% average system readiness rate, with no launcher out of service for more than 24 hours (DoD, 2006). Since the program's inception, the PBL has consistently exceeded performance requirements.

Lockheed Martin relies on a database that tracks the location of each launcher, including each spare part, and indicates whether the part is functional. There are 26 field service representatives (FSRs) that operate from 22 locations, eight of which are overseas (Hawkins, 2009). In-theater maintenance work is performed by soldiers, with the assistance of FSRs. Early on in the PBL program, Lockheed Martin reduced the number of diagnostics devices provided to each battalion from six to one in order to streamline the repair process.

In addition, early improvements in processes and design modularity allowed soldiers operating HIMARS in the field to remove and replace defective components quickly and easily. Perhaps one of the greatest benefits of the PBL is the provision of limited depot-level repair capability at each battalion, where repair work is provided by the FSR. Referred to as the capability to "Fix Forward," some 50% of HIMARS repairs are performed on location by the FSRs, eliminating wait times and significantly reducing costs (Hawkins, 2009). This in-the-field repair capability has also significantly improved deployed launcher availability. According to interviews with Lockheed Martin officials, FSRs voiced few concerns over their work environments, safety, or civilian status within the battalion, with several volunteering to return.

In 2015, the DoD transitioned inventory management from the contractor to the government in an effort to further reduce costs. It remains to be seen whether the DoD's decision will lead to lower costs and continued high performance.

AH-64 Apache

The AH-64 Apache was conceptualized as a high-powered, tank-killing attack helicopter, capable of repelling conventionally ground forces during a Soviet invasion of Europe. Still an essential part of the Army's fleet today, the primary mission of the Apache is to perform armed reconnaissance and conduct rear, close, and shaping missions, including deep precision strikes.

Since its inception, the Apache has accumulated over 3.9 million flight hours, with operational deployments during Desert Storm, Operation Iraqi Freedom, Operation Enduring Freedom, and Operation Inherent Resolve in Iraq. Central to the Apache's mission is the Modernized Target Acquisition Designation Sight/Pilot Night Vision Sensor (M-TADS/PNVS) system, nicknamed the "eye of the Apache." The system, consisting of two subsystems, enables Apache pilots to fly at low altitudes in total darkness and poor weather conditions, while also providing the capability for the co-pilot to identify and engage hostile targets (Cothran, 2012).

Since 2007, Lockheed Martin has provided sustainment for the AH-64 Apache Helicopter's M-TADS/PNVS system. The Apache sensors PBL relies on a firm-fixed price contract that is tied to the number of flight hours. This structure is ideally suited to heavily-deployed systems, such as the Apache, in that it provides the contractor with the traditional incentives associated with fixed-price contracts, translating to higher levels of innovation, reliability, and availability; at the same time, the contract is flexible, which ensures that the system is capable of supporting changes in operational tempo without unduly impacting tactics and strategy. The first four-year contract was valued at approximately $380 million; in 2012, a similar follow-on contract valued at $375 million was awarded (Lockheed Martin, 2012).

Lockheed has consistently achieved a supply availability rate of approximately 97%. The contract established a system of continuous improvements supporting the Apache sensors and covered complete post-production supply chain management, including inventory management, maintenance, modifications, procurement, repairs, and spares planning of fielded systems.

Under the initial contract, Lockheed successfully slashed sustainment costs for both sensor systems and improved supply availability primarily through improvements in supply chain and obsolescence management. Lockheed has lowered logistics and maintenance costs by leveraging data tracking for a number of health and maintenance indicators to improve demand forecasting, by determining appropriate inventory levels, and by ensuring the optimal locations of supply activities.

Other achievements include a monthly minimum supply availability rate of 96%, a 99% availability rate for depot repair parts, and material reliability improvements, leading to a 70% increase in Mean Time Between Failures. The PBL contract has also been credited with improving fleet readiness, reducing average flying hour cost and reducing the Army's long-term inventory investment. Over the course of the initial PBL contract, depot level repairable costs were reduced by 18%, supply inventory replenishment costs were reduced by 40%, and mean-time between maintenance actions was reduced by 9.6% (DoD, 2012).

Annual sustainment costs prior to the implementation of PBL totaled $218 million per year. In 2013, costs totaled $92 million, a drop of 58%. Other accomplishments include the

mitigation of 759 obsolescence and diminishing manufacturing cases since 2007, resulting in $104.2 million in cost avoidance, the reduction of the maintenance support footprint, and a decrease of over 1,000 maintenance man hours per year through increased materiel reliability (DoD, 2012).

H-60

The H-60 is the U.S. Navy's family of multipurpose twin-engine, medium-lift helicopters—the legacy SH-60B, SH-60F, HH-60H, and the new MH-60R and MH-60S. These aircraft share upgraded mission systems, avionics, and components, including a common cockpit that allows pilots to shift from one aircraft to another with minimal retraining. The MH-60R, first deployed in 2009 to aid in Operation Iraqi Freedom, is a multi-purpose aircraft with many missions, including vertical replenishment, search and rescue, special operations support, and mine countermeasures, though its primary mission is anti-submarine and surface warfare.

The provision of traditional support for the H-60 was complicated by the number of versions that were in service, the length of their service, and the introduction of the two new models. The high operational tempo of the aircraft, combined with the unique challenges of maintaining rotary wing aircraft (e.g., the corrosive effects of maritime operations), led to increasing operating and support costs and lower availability (Heron, 2010). Obsolete parts represented an additional problem. Procurement necessitated the repair of small batches of custom-made parts, often at high cost, or undertaking expensive engineering changes to the aircraft to enable the use of newer parts.

A 1996 GAO report noted that one specific part "had a repair time of 232 hours, only 20 hours of which was spent actually repairing the item, [and that] the remaining 212 hours involved time to handle and move the part to different locations." In 2002, the Navy sought a new product support strategy. To this day, the Navy relies on a suite of fixed-price PBL contracts that, in effect, cover maintenance and repair of the entire aircraft. The largest of these, the Tip-to-Tail (T2T) PBL program, supports over 1,200 parts (avionics and airframe).

The original five-year T2T contract covered legacy models. It was awarded to a joint venture between Lockheed Martin Systems Integration (LMSI) and Sikorsky Aircraft Company in December 2003. Valued at approximately $417 million, the PBL provided requisition processing, requirements forecasting, inventory management, repair, overhaul, modification, packaging, handling, storage, transportation, configuration and obsolescence management, and reliability and technology improvement (Lockheed Martin, 2004). In order to capture contractor performance in the provision of these tasks, the PBL relied on a single metric, fill rate, which measures the percentage of requisitions filled on time.

Following the expiration of the initial contract, the Navy sought to use contractor cost data in order to develop the basis for the fixed-price follow-on contract. Following a series of challenging negotiations, the contractor supplied the data and in December 2010, the T2T was renewed for four years at an estimated five-year projected cost of $1.4 billion (DoD, 2010). As the price increase indicates, the contract was expanded to cover the newer models, the MH-60 R and S.

Since its implementation, the PBL has exceeded the established minimum fill rate (80%), averaging a rate of 88% (19% above the pre-PBL rate). Furthermore, the fill rate for special management items has also increased, from 80% to 99%. In addition, backorders were reduced by over 90% (Skotty, 2012).

Findings

In order to ensure the nation's continuing technological superiority and better prepare for the rapidly changing global environment, the DoD must strive to reduce life cycle costs, improve system availability, and incentivize innovation.

Based on our examination of the PBL mechanism, its proven applications, and four PBL-supported systems, we provide our findings.

1. **PBL-supported systems operating in stressful environments are capable of meeting or exceeding performance requirements, contributing to mission success.**

   In all four cases, the PBL programs met or exceeded performance requirements in operational availability and readiness. In light of new and emerging threats, a program's proven ability to consistently meet high performance standards in excess of 90, 95, or 99% availability/readiness cannot be overstated.

2. **PBL contractors have the proven ability to support weapons systems operating in stressful environments.**

   Over the last several years, there has been unprecedented contractor participation (in numerous roles) in the conflicts in Iraq and Afghanistan, with some voicing concern over the presence of "contractors on the battlefield." Needless to say, a line must be drawn between contractor support and direct participation in combat operations, but as these cases illustrate, this has not been an obstacle. The four cases also demonstrate that PBL contractors are willing and able to perform a critical supporting role, even in stressful environments.

3. **PBL provides sufficient flexibility and capacity to adapt to changing operational tempos.**

   The four cases suggest that PBL programs are adaptable and scalable, provided that they are structured appropriately. PBLs relying on cost-plus contracts provide inherent flexibility (to the government and the contractor) in the face of uncertainty, both technical and operational. Fixed-price PBLs also provide flexibility, especially when price is tied to operational tempo (number of flight hours, miles driven).

4. **All support contracts, including PBLs operating in theater, should apply stringent cost controls.**

   Owing in part to demonstrated success of PBL in meeting performance requirements, it may be that less attention is paid to contract specifics beyond readiness/availability metrics. Carefully-considered contract ceilings, cost-per-unit usage rates, and logistics footprint constraints should be included in cost-plus contracts. Without these features, contractors may be incentivized to accrue surplus inventory beyond what is necessary to meet the performance requirement.

Recommendations

Based on these findings, we provide the following recommendations to the DoD.

1. **Promote the use of PBL as a proven support strategy for weapons systems.**

   PBLs perform better than traditional support mechanisms, even in stressful environments. The DoD should renew its commitment to the expansion of PBL in order to improve weapons systems operation and reduce costs.

2. **Ensure proper alignment of government objectives with provider incentives.**

   Critics suggest, perhaps rightly, that PBL arrangements can be more challenging to develop and manage than other contract types. Just as an appropriate PBL program structure aligns the incentives of the customer (the government) and the support provider, leading to a win-win scenario, an inappropriate structure can create perverse incentives and result in undesired or unintended consequences.

3. **Structure PBL contracts appropriately.**

   In environments characterized by relatively low levels of uncertainty, both operational and technical, alignment of contractor and government objectives is optimized under fixed-price PBL contracts. These arrangements promote greater cost-reduction incentives, higher levels of innovation, and enhanced reliability. Often, these contacts rely on only one or two performance metrics, which ensures transparency and accountability. However, in stressful, unpredictable environments, cost-plus PBL contracts are often more suitable in that they provide greater flexibility to meet mission objectives. In these circumstances, however, programs may need to employ additional metrics beyond reliability and availability, including cost-per-unit usage rates and logistics footprint constraints, in order to strike the optimal balance between required availability and cost.

4. **Avoid distortions to the PBL paradigm.**

   From a theoretical standpoint, the power of PBL lies in affording the provider the discretion and flexibility to select the optimal mix of inventory levels, maintenance activities, and technology upgrades in order to meet performance requirements. Shifting one or more of these functions to the government customer distorts the PBL paradigm and may lead to reductions in performance and higher costs.

References

Boyer, M., Shurkin, M., Wong, J., Schwankhart, R., Albrich, A., Lewis, M., & Pernin, C. (2015). *Assessing conventional army demands and requirements for ultra-light tactical mobility.* Santa Monica, CA: RAND.

CBO. (2007). *Replacing and repairing equipment used in Iraq and Afghanistan: The Army's reset program*. Retrieved from https://www.cbo.gov/sites/default/files/110th-congress-2007-2008/reports/09-13-armyreset.pdf

Coryell, B. (2007). *Performance-based logistics, contractor logistics support, and Stryker* (Master's thesis). Fort Leavenworth, KS: U.S. Army Command and General Staff College.

Cothran, J. (2012, July). Lo*ckheed Martin PBL programs description and data for CAPE analysis.* Corporate Logistics and Sustainment, Lockheed Martin Corporation.

DoD. (2006). *The Secretary of Defense PBL Awards Program for Excellence in Performance-Based Logistics, summary of criteria accomplishments: HIMARS*.

DoD. (2012). *The Secretary of Defense PBL Awards Program for Excellence in Performance-Based Logistics, summary of criteria accomplishments: Apache M-TADS/PNVS.*

DoD Inspector General (DoD IG). (2012). *Better cost-control measures are needed on the Army's cost-reimbursable services contract for logistics support of Stryker Vehicles* (DoDIG-2012-102). Washington, DC: Author.

GAO. (2006). *Defense logistics: Changes to Stryker vehicle maintenance support should identify strategies for addressing implementation challenges* (GAO-06-928R). Washington, DC: Author.

Gardener, C. (2008). *Balancing government risks with contractor incentives in performance-based logistics contracts* (Master's thesis). Wright Patterson Air Force Base, OH: Air Force Institute of Technology.

Hawkins, K. (2009). HIMARS shoots high for award. Retrieved from U.S. Army website: http://www.army.mil/article/31909/HIMARS_Shoots_High_For_Award/

Heron, J. (2010, November 18). PowerPoint presentation at Defense Acquisition University.

Irwin, S. (2013). Industry and government butt heads over weapons maintenance contracts. *National Defense*.

Lockheed Martin. (2004, January 8). Sikorsky venture wins $417 million contract [Press release].

Lockheed Martin. (2012). U.S. Army awards Lockheed Martin $111 million Apache M-TADS/PNVS performance based logistics contract. [Press release]. Retrieved from http://www.lockheed.com/m/us/news/press-releases/2012/september/mfc-092412-usarmyawards.html

Lockheed Martin. (2016, January 12). HIMARS achieves one million operational hours milestone [Press release].

Skotty, R. (2012). PowerPoint presentation at Defense Acquisition University.

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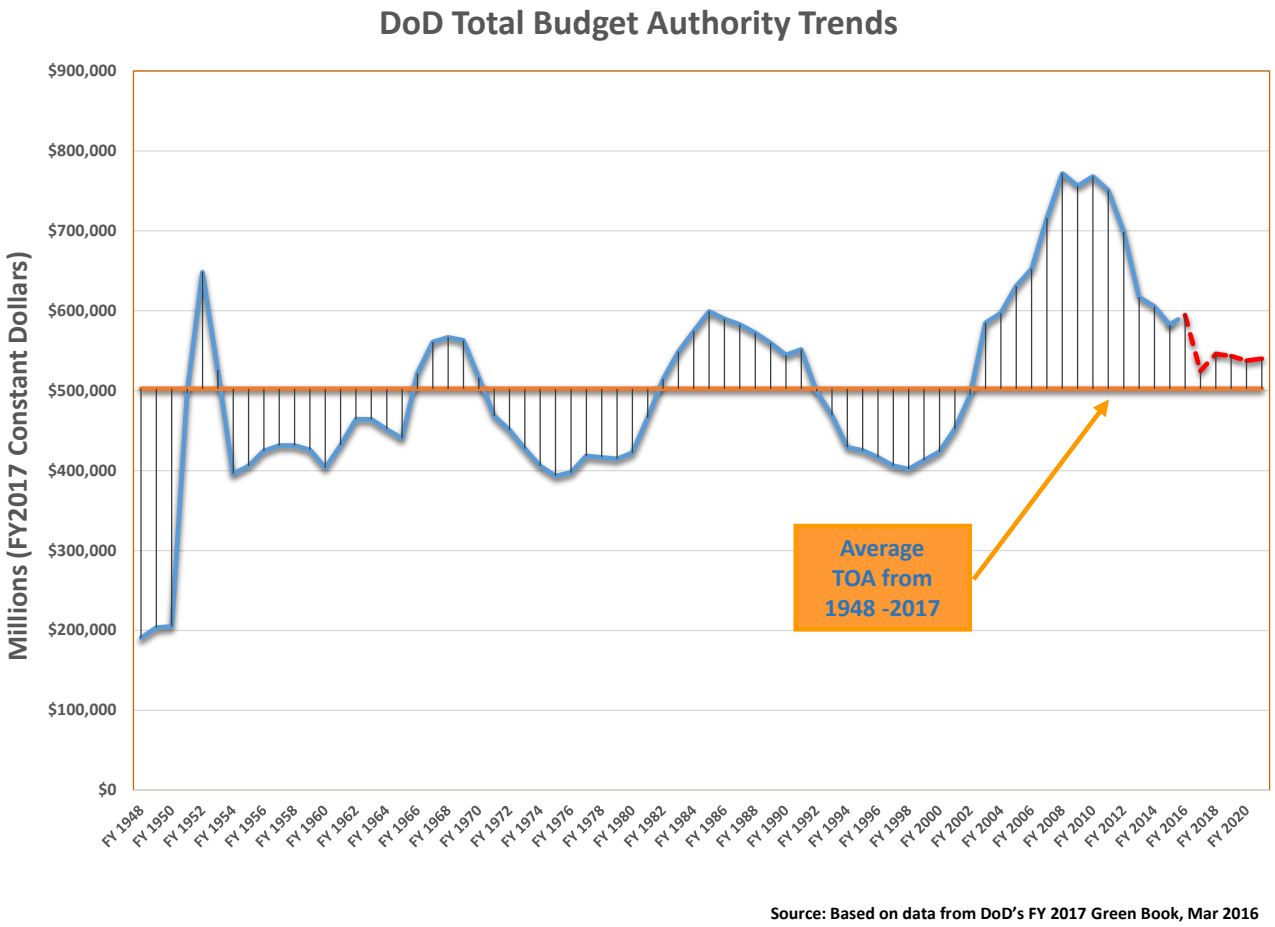
Presentation Outline

- Introduction
- 4 PBL Cases
  - HIMARS
  - Stryker
  - AH-64 Apache Sensors
  - H-60 “Tip to Tail”
- Findings
- Recommendations

Trends in Defense Appropriations



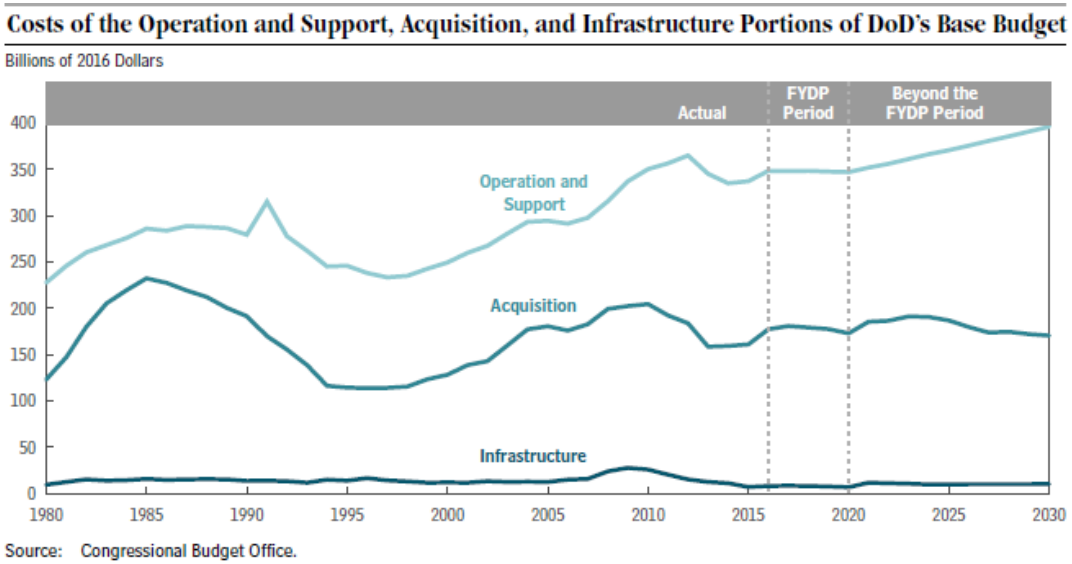
Source: Based on data from DoD's FY 2017 Green Book, Mar 2016

We can anticipate continued budgetary pressure; at the same time, equipment is worn out and requires repair and modernization.

Additional Cuts are Possible

At the Same Time O&S Costs are Rising

- The O&S budget includes costs of operating and maintaining major weapon systems—these costs also have increased more rapidly than base inflation.
- A large share of the O&S budget also goes to pay civilian DoD personnel, including the rising health care costs.



Source: CBO, Long-term Implications of the 2016 Future Years Defense Program, Jan 2016.

Rising O&S costs are squeezing out other investments

Product Support Must be Improved

- Federal budget pressures will limit the number and scope of new platforms and systems for foreseeable future.
  - A smaller force increases the value of each weapons system available to the warfighter.
  - Thus, high levels of availability for platforms and weapons systems will be essential.
- Twin objectives: reduce costs, and increase performance–both can be achieved through the expanded implementation of performance based logistics.
  - Contracting for performance (as defined by the users) aligns the military Services' and PBL providers' interests, altering the providers' incentives.
  - This results in increased performance at a decreased price.
  - Inherent in PBLs is the transfer of some program risk from the military Service to the PBL provider.

The need to improve efficiency has never been greater

Performance Based Logistics

- The use of PBL is not aggressively pursued across the DoD.
  - Over 200 PBL contracts in 2005; only 87 by 2013.
  - However, total PBL expenditure has increased significantly, partially due to expansion within successful programs.
- Research Questions: Are product support providers able and willing to perform in support of emergency and contingency operations?
- During the recent conflicts, weapons systems often operated at rates that exceeded—sometimes by factors of five or six—their average operating rates during peacetime.
  - Chief among these were combat vehicles and helicopters.
- We examine PBL support to four systems: the High Mobility Artillery Rocket System (HIMARS), the Stryker Armored Combat Vehicle, the Apache AH-64 helicopter, and the Navy H-60 helicopter.

HIMARS

- Wheeled rocket and guided missile system—a lighter, transportable version of the M-270 MLRS.
- Easily deployed to areas previously inaccessible to heavier launchers.
- System has fully enclosed, armored cab and a launcher pod of 6 rockets.
- Deployed since 2004—played a significant role in operations in the Al Anbar province of Iraq.

HIMARS PBL

- **LCCS I ($96 M)**
  - PoP : 2004-2007
  - Customer: US Army
  - Type: FFP/CPFF
- **LCCS II / LCLS ($248 M)**
  - PoP: 2008-2013
  - Customer: U.S. Army and USMC
  - Type: FFP/CPFF
- **LCLS III**
  - PoP: 2014-2018
  - Type: CPFF* with incentives

SCOPE

- **Supports 603 Fielded Systems**
- Performance Based Logistics (Service)
  - Repairs and Spares for Fielded Systems
  - 80 critical Launcher/Fire Control System LRUs
  - Performance Metrics
- 26 Field Service Representatives (FSRs)
  - Providing Onsite and Geographic Support
  - 22 Locations (8 Overseas)
- Contractor managed supply chain Spares Deliveries (Hardware Deliveries)
  - Unit/Management Reserve Spares
  - Pipeline replenishment
  - FMS Spares

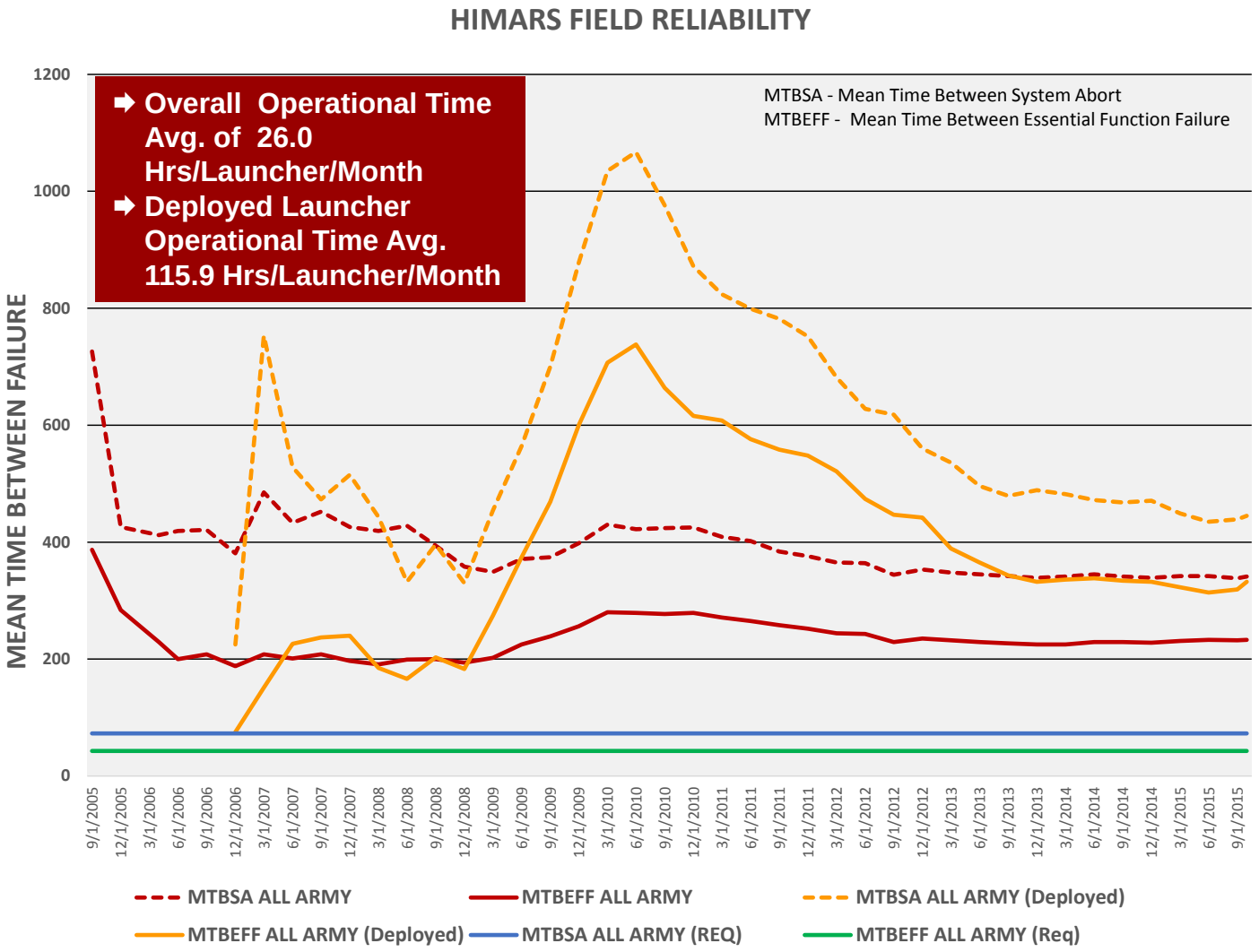
* Although there is ample evidence that fixed-price performance-based contracts induce the provider to choose the optimal inventory level, the government believes that it can reduce costs through more direct control. It remains to be seen whether the DoD's decision will lead to lower costs and continued high performance.

HIMARS PBL Performance

- Contract Metric: System Status Readiness (Ao)
  - Contract Standard: 92%
  - PBL performance: 99%+
  - CONUS MICAP* delivery standard: 24 hrs.; actual: 14 hours
  - OCONUS MICAP delivery standard: 96 hrs.; actual: 1 hour
  - Repair Turn-Around-Time (on-site repair standard): 5 days; actual: 1.2 days
  - Repair Turn-Around-Time (vendor repair standard): 45 days; actual: 34 days
- Cost Reduction
  - Documented BCA-validated savings: $490M
  - Contractor investment in FSRs yielded add'l $130M in savings
- Received the OSD PBL Award twice: 2006, 2009

*Mission Impaired Capability Awaiting Parts

HIMARS PBL Performance (cont.)



Stryker

- Stryker Combat Vehicle
  - Stryker is a family of eight-wheel-drive combat vehicles.
  - Rapidly-deployable wheeled armored vehicle, transportable in a C-130 aircraft.
  - The Stryker can travel at speeds up to 62 mph on highways with a range of 312 miles on 53 gallons of fuel.

- Stryker uses a Caterpillar engine, common to the Army's family of medium tactical vehicles.
- It has an integrated armor package protecting soldiers against improvised explosive devices, rocket propelled grenades, and a variety of infantry weapons.
- Among fastest acquisitions of any major Army system.

Stryker PBL

- First five-year PBL contract awarded in 2002 to GD
  - CPFF contract provided flexibility to meet rapidly-evolving conditions.
  - Contractor responsible for all ordering, management, distribution of parts, and vehicle maintenance.
  - Contractor personnel filled a variety of roles:
    - Vehicle mechanics
    - Armament repairers
    - Automated logistics specialists
- Follow-on PBL contract was a 6-year (base year and 5 option years), CPFF contract awarded for the increasing number of vehicles: as of February 2013 was funded for approximately $1.6B

Stryker PBL Performance

- Contract required monthly readiness rate of 90% during deployments; 98% stateside
  - Stryker exceeded expectations, achieving, 95% cumulative readiness during the height of the war in Iraq.
  - Stryker vehicles were driven in excess of 5.6 million miles during the first two deployments—800% higher than anticipated usage.
- In 2005, Army initiated transition from contractor to soldier maintenance.
  - 71 soldiers required to replace 45 Stryker vehicle maintenance contractors.
  - Transition questioned by GAO, but still underway.

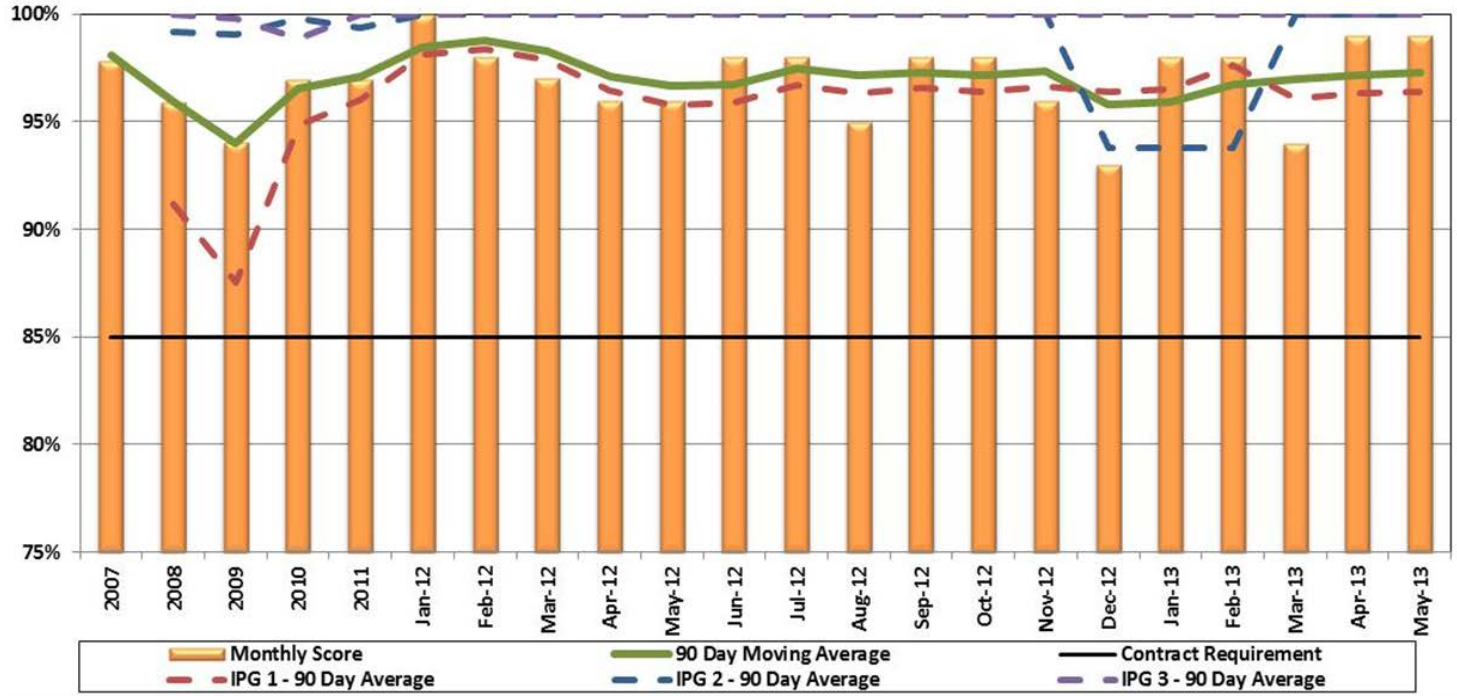
AH-64 Apache Sensors

- Attack helicopter that performs armed reconnaissance, rear, close, and shaping missions, including deep precision strikes.
- Over 3.9 million flight hours with deployments during Desert Storm, Iraqi Freedom, Enduring Freedom, and Inherent Resolve.
- Central to the Apache's mission is the Modernized Target Acquisition and Designation Sight/Pilot Night Vision Sensor (M-TADS/PNVS) system, nicknamed the "Eye of the Apache."

AH-64 Apache Sensors PBL

- PBL supports over 670 aircraft in 27 battalions worldwide, including multiple forward operating bases.
- PBL has relied on FFP contracts tied to number of flight hours
  - Provides Army the needed flexibility to contract for actual usage.
  - Maintains contractor incentives to innovate and improve reliability.
- 2007: First four-year contract (base year and three one-year options): $380 million
- 2012: Follow-on four-year contract: $375 million
- 2016: Third PBL contract, five-year, (base year and four one-year options): $424 million
  - Represents a price decrease of 10% compared to the previous contract.

AH-64 Apache Sensors PBL Performance

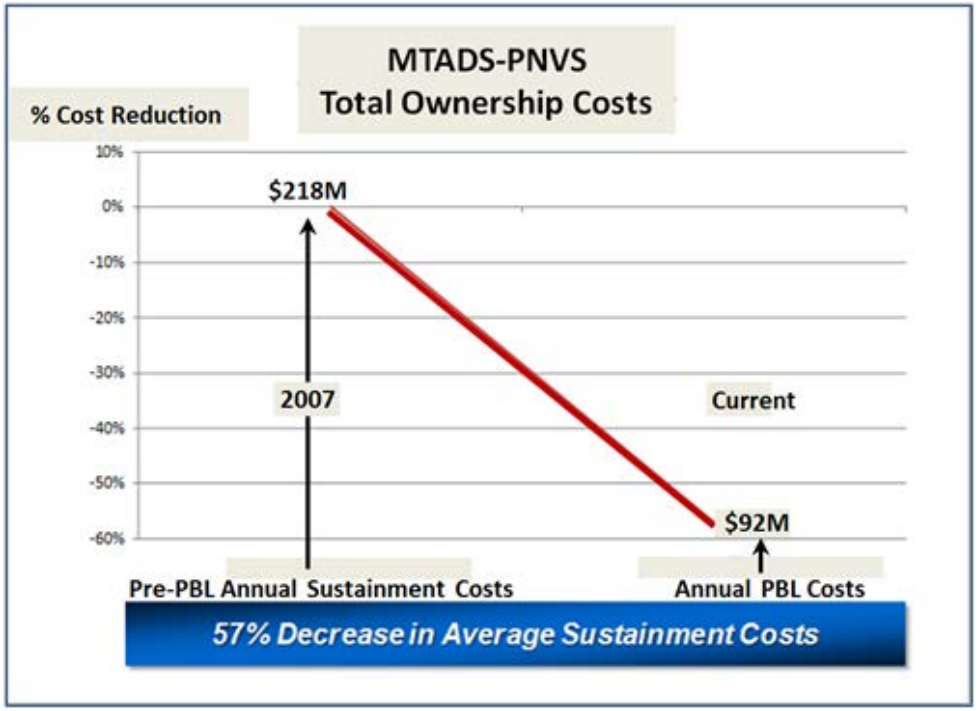


- Contract Metric: MTADS/PNVS subsystem availability**:** 85%
  - **PBL performance 2007-2013: 97%**
- This availability maintained during peak OPTEMPO (2011-2013) of >200,000 flying hrs.
- 2012-2013: **99% SA** for deployed units--Highest level of support for those in harm's way.

AH-64 Apache Sensors PBL Performance (cont.)

- Reliability
  - July 2010 to present: over 100% increase in MTBF
  - Targeted contractor investments in product & process improvement
- Total Ownership Costs

Over 50% reduction in average annual sustainment cost



Seahawk

- Family of multipurpose twin-engine, medium-lift helicopters.
- New aircraft have updated mission systems, avionics.
  - Including a common cockpit allowing pilots to shift from one aircraft to another with minimal retraining.
- Seahawk helicopters were used for a variety of missions in Iraq.

Seahawk "Tip-to-Tail" PBL

- Tip-to-Tail (T2T) PBL, initially a joint venture between Lockheed Martin and Sikorsky.
  - As with the Apache Sensors PBL, contract price is tied to flight hours.
  - Supports Navy, Coast Guard, and foreign customers.
- 2003: $417M five-year, FFP contract for legacy H-60
  - Initially supported over 500 parts (airframe and avionics).
  - Contract modified over time to support over 1,200 parts in 2008 for a total contract value of $900M.
- 2009 and 2010: Two one-year "bridge" contracts awarded
  - Navy wanted visibility into contractor cost data.
  - Contractor wanted longer contract term, the Navy a shorter term.
- 2010: Negotiations resulted in $1.4B four-year FFP contract (no options).
  - Contractor cost data used to inform pricing.
  - Contract covers both legacy H-60s and newer MH-60R/S.
  - One of the largest PBL contracts in Navy history.

Seahawk Tip-to-Tail PBL (Cont.)

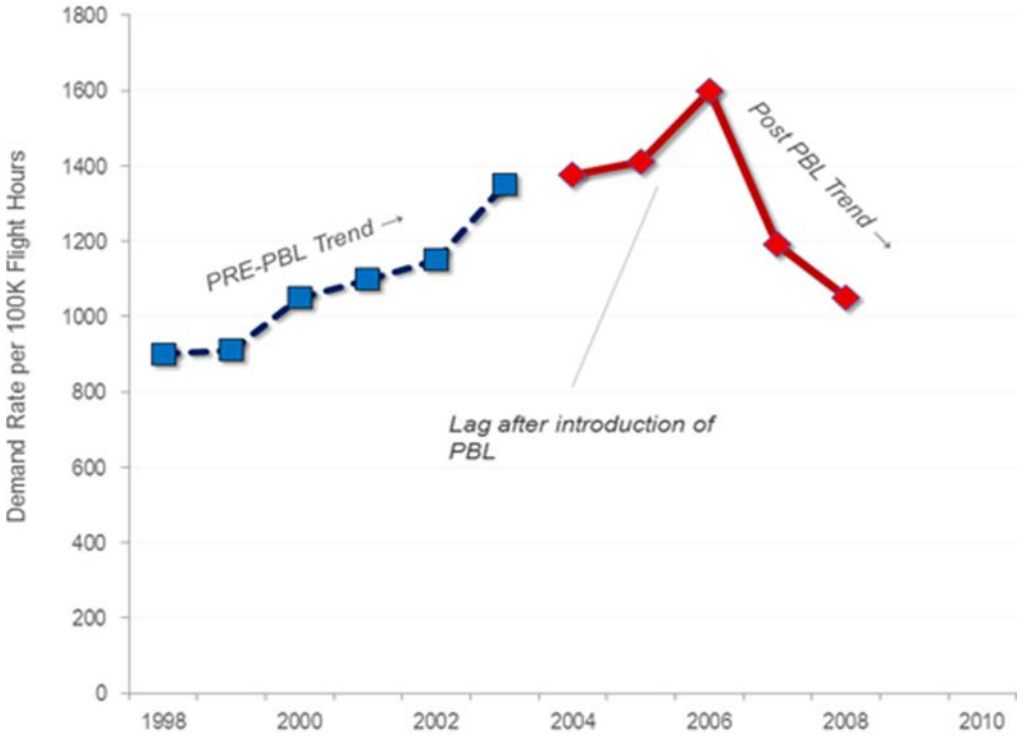
- PBL provides requisition processing, requirements forecasting, inventory management, repair, overhaul, modification, packaging, handling, storage, reliability, technology, and more.
- Major repairs performed by OEMs and PPPs with naval depots.
  - PBL increased reliance on intermediate-level repairs by funding FRC specialists to assist aboard ship with Aircraft Intermediate Maintenance Departments.
- Primary Performance Metric: Supply Response Time (percentage of requisitions filled on time) -- deliver at least 80% of all requisitions within a specified time dependent on the priority of the requisition.

Seahawk Tip-to-Tail Performance

- Contract Metric: Supply Response Time/Fill Rate
  - Contract Standard: 80% PBL performance: 98%+
  - Backorders reduced from over 400 to 24 across 1600 LRUs

Seahawk Tip-to-Tail Performance (cont.)

- Secondary Performance Indicators—lower demand rate for parts despite ageing legacy aircraft and higher OPTEMPOs during conflicts.
- Business case analysis indicated first PBL provided savings of $41M over five years; $46M for second PBL.



Conclusions/Findings

- PBL supported systems operating in combat environments are capable of meeting or exceeding performance requirements, contributing to mission success, often reducing costs.
- PBL contractors have the proven ability to support weapons systems operating in stressful environments.
- PBL provides sufficient flexibility and capacity to adapt to changing operational tempos.

Recommendations

- Promote the use of PBL as a proven support strategy for weapons systems
  - PBL performs better than traditional support mechanisms, even in stressful environments.
  - The DoD should renew its commitment to the expansion of PBL in order to improve weapons systems operation and reduce costs.
- Ensure proper alignment of government objectives with provider incentives
  - An appropriate PBL contract aligns the objectives of the customer and the support provider, leading to a win-win scenario.
  - However, an inappropriate structure can create perverse incentives, and result in undesired or unintended consequences.

Recommendations (Cont.)

- Avoid distortions to the PBL paradigm
  - The power of PBL lies in affording the provider the flexibility to select the optimal mix of inventory levels, maintenance activities, and technology upgrades in order to meet performance requirements.
  - Shifting one or more of these functions to the government customer distorts the PBL paradigm and may lead to reductions in performance.
- Structure PBL contracts appropriately
  - In unpredictable environments, cost-plus contracts are often more suitable.
  - However, programs should implement cost controls through the use of additional metrics beyond availability, e.g. cost-per-unit usage rates, logistics footprint constraints.